

Claims

What is claimed is:

1. A medical device comprising a tubular body having a proximal end, a distal end, and a longitudinal axis extending at least from the proximal end to the distal end; and a plurality of slots formed into said body, said slots being configured to enhance the bending flexibility of said body; the medical device being characterized by a polymer liner inside at least part of said body, said liner covering at least some of said slots; and at least a portion of said liner comprising an anti-collapsing structure.
2. The medical device of claim 1, said anti-collapsing structure being helical.
3. The medical device of claim 1, said anti-collapsing structure being annular.
4. The medical device of claims 1, 2, or 3, said anti-collapsing structure comprising at least one wire.
5. The medical device of claim 4, said wire being ribbon wire.
6. The medical device of any of the preceding claims, said anti-collapsing structure being bonded to said liner.
7. The medical device of any of the preceding claims, said anti-collapsing structure comprising at least one groove formed in said liner.
8. The medical device of any of the preceding claims, said anti-collapsing structure comprising at least one corrugation formed in said liner.
9. The medical device any of the preceding claims, said anti-collapsing structure comprising a braid.
10. The medical device of any of the preceding claims, said liner being formed from at least two layers.
11. The medical device of claim 10, said anti-collapsing structure being located between said layers.
12. The medical device of any of the preceding claims, said liner comprising at least one corrugation extending outward from said anti-collapsing structure.
13. The medical device of any of the preceding claims, said liner comprising at least one corrugation extending inward from said anti-collapsing structure.
14. The medical device of any of the preceding claims, said slots substantially defining a plurality of segments of said body, said segments forming a

substantially helical pattern at least part way along said axis, and said plurality of segments being separated along said substantially helical pattern by said slots.

15. The medical device of claim 14, each said slot having two end points and a midpoint; said segments being substantially between said end points of adjacent said slots; and at least a plurality of said segments being substantially between said midpoints of two axially adjacent said slots.

16. The medical device of claim 14 or 15 wherein alternating said segments along said axis form said substantially helical pattern.

17. The medical device of claims 14 - 16, each said slot being substantially in line with at least one other said slot; and said segments being between adjacent said substantially in-line slots.

18. The medical device of any of the preceding claims, each said slot being substantially parallel to at least two other said slots.

19. The medical device of any of the preceding claims, said slots being arranged in a plurality of groups; each said slot being substantially perpendicular to said axis; and each said slot in a said group being substantially equally spaced around said axis.

20. The medical device of claim 19, each said slot in a said group being located at substantially the same location along said axis.

21. The medical device of claim 19 or 20, at least a plurality of said groups comprising two slots.

22. The medical device of claim 19, 20, or 21, at least a plurality of said groups comprising three slots.

23. The medical device of claim 19 - 22, each longitudinally adjacent said group being rotated around said axis from the previous said group forming said helical pattern along said axis.

24. The medical device of claim 23, said rotated around being by an angle slightly different than 180 degrees divided by the number of said slots in said group, said slightly being more than zero degrees and less than 10 degrees.

25. The medical device of any of the preceding claims, said body being nitinol.

26. The medical device of any of the preceding claims, further comprising a central wire disposed at least partially inside said body.

27. The medical device of claim 26, said central wire being slidable inside said body.
28. The medical device of claim 26, said central wire being a core wire, said core wire being attached to said body.
29. The device of claims 26 - 28, said central wire including at least one bend formed therein.
30. The medical device of any of the preceding claims, the medical device being a catheter.
31. The medical device of any of the preceding claims, further comprising a hollow annular space between said liner and said body.
32. The medical device of any of the preceding claims, said slots having rounded corners.
33. The medical device of any of the preceding claims, said distal end comprising a substantially radiopaque marker.
34. The medical device of any of the preceding claims, the medical device being a guidewire.
35. The medical device of any of the preceding claims further comprising a coil coaxial with said tubular body.
36. The medical device of any of the preceding claims, said slots being arranged with a varying longitudinal spacing, said spacing generally decreasing from said proximal end to said distal end.
37. The medical device of any of the preceding claims, said slots having a varying depth, said depth generally increasing from said proximal end to said distal end.
38. A method of making a medical device with a flexible, kink-resistant tubular member, the method comprising the steps of: providing a tubular member; providing an anti-collapsing structure concentric with the tubular member, the anti-collapsing structure having a plurality of sections; and deforming the tubular member between the sections into a corrugated shape.
39. The method of claim 38, said deforming comprising applying heat.
40. The method of claims 39 or 39, at least part of the anti-collapsing structure having a helical shape comprising a plurality of loops, the sections being the loops.

41. The method of claims 38, 39, or 40, the anti-collapsing structure comprising at least one wire.
42. The method of claim 41, the wire being ribbon wire.
43. The method of claims 38 - 42, further comprising the step of bonding the anti-collapsing structure to the tubular member.
44. The method of claims 38 - 43, said deforming comprising applying internal pressure to the tubular member.
45. The method of claims 38 - 44, said deforming comprising applying tension to the tubular member in the axial direction.
46. The method of claims 38 - 45, said deforming comprising applying compression to the tubular member in the axial direction.
47. The method of claims 38 - 46, said deforming comprising using a mold.
48. The method of claims 38 - 47, the tubular member comprising two layers, the anti-collapsing structure being located between the two layers.
49. The method of claims 38 - 48, the method further comprising the steps of: providing a tubular body having a proximal end, a distal end, and a longitudinal axis extending at least from the proximal end to the distal end; forming a plurality of slots into the body; and arranging the body so that the body is concentric with the tubular member.
50. The method of claims 38 - 49, the bending stiffness of the tubular member varying along its length by varying the pitch of the anti-collapsing structure.
51. The method of claims 38 - 50, the bending stiffness of the tubular member varying along its length by varying the wall thickness of the tubular member.
52. The method of claims 38 - 51, the bending stiffness of the tubular member varying along its length by varying the corrugated shape along the tubular member.